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drop, depending on the strength of the agent, and a clear zone arises between this ring and the general sperm suspension. The clear zone is produced by migration of spermatozoa to the ring; in case the agent is very strong the ring expands, owing to immigration of spermatozoa, but the clear zone is never obliterated, no matter how much the ring may expand. In the case of *Nereis*, which has unusually large spermatozoa, the passage of spermatozoa across the clear zone to the ring may be readily studied under a low power of the microscope, and it gives the impression of a regular rain falling on the ring.

In the case of *Nereis* all acids tested are aggregating agents ( $\text{CO}_2$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{HNO}_3$ ,  $\text{HCl}$  and  $\text{CH}_3\text{COOH}$  were studied), but do not agglutinate, and alkalis ( $\text{K}$ ,  $\text{OH}$  and  $\text{NaOH}$  only studied) are agglutinative but not aggregative. The sperm of *Nereis* is extremely sensitive to acids, reacting positively to  $N/1,000$   $\text{H}_2\text{SO}_4$ ,  $\text{HCl}$ ,  $\text{HNO}_3$  and  $N/2,000$  acetic, and to  $1/200$  dilution of a saturated solution of  $\text{CO}_2$  in sea-water. The phenomena of aggregation were therefore studied, particularly in the case of *Nereis*. The sensitiveness of *Arbacia* sperm to acids is three or four times less than that of *Nereis* sperm, but the reactions are in the same sense.

If an acid or other aggregative agent alone be present in the drop tested in the suspension beneath a raised cover slip, the ring which forms is perfectly continuous and the individual spermatozoa are separate. If an agglutinin as well as an aggregative agent be present, the ring forms and breaks up into agglutinated masses. If the agglutinin alone be present no ring proper forms, or there is no outer clear zone, and agglutinated masses form within the drop as described. The egg-secretions give the double reaction.

V. Von Dungern's experiments (*Zeitsch. f. allgem. Physiologie*, I., pp. 34-55, 1902) are the only ones, so far as I know, in which the production of sperm agglutinins by ova was investigated, and he discovered only hetero-agglutinins, no iso-agglutinins. He did, indeed, describe the loss of motility of spermatozoa in egg-extracts of the same species, but

he entirely missed the phenomenon of agglutination and its reversal. He reveals the reason for this failure by his remark that he always examined for the effect of the "egg-poison" about half an hour after its addition to the sperm; but the phenomenon of agglutination and its reversal are completed in about five minutes.

Von Dungern also made experiments on the production of immune sera by injection of ova and spermatozoa separately into rabbits, and found that both caused the production of a sperm agglutinin in the rabbit's serum. From this he concludes that both kinds of reproduction elements possess chemically identical complexes of molecules in the protoplasm. While this may be admitted as at least a very probable conclusion, his farther conclusion that fertilization does not depend upon any specific antagonism between ovum and sperm, but is conditioned by the similarity of their protoplasms, is not well founded, for the egg is a very complicated chemical system, and it certainly contains molecules antagonistic to sperm, even if, as von Dungern's experiments indicate, it also contains some that are not.

VI. The existence of sperm iso-agglutinins in ova offers the possibility of an explanation of the specificity of fertilization on the basis of the laws governing antigens and antibodies, if these agglutinins are specific, as is so strongly suggested by the experiments. The union of ovum and spermatozoon is not a process in which the sperm penetrates by virtue of its mechanical properties, but one in which a peculiarly intimate and specific biochemical reaction plays the chief rôle. A later publication will give the details of the experiments and a more complete analysis of the behavior of the spermatozoa in fertilization.

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September 16, 1912

#### PRELIMINARY NOTE ON PRISTINA AND NAIDIUM

THESE two genera, *Pristina* and *Naidium*, of the aquatic oligochaetes, have been combined and separated by recent systematists with quite startling rapidity. The former genus was first described by Ehrenberg in

1831, and *Naidium* by O. Schmidt in 1847. In 1875, Beddard combined them under the prior name. In 1900, Michaelsen restored them as separate genera, and again combined them in 1909. These two genera are more alike than any other two genera in the family Naididæ, and than many species in some of the genera. They differ only in the development of the prostomium, which varies widely within the same species, and in the presence of bifid setæ in the dorsal bundles of *Naidium*. This is no more reason for keeping them apart than it would be to make *Nais tortuosa* and *N. parviseta* separate genera, because the latter has bifid setæ in the dorsal bundles. Michaelsen, in recombining the two species, gives no reason for so doing; but Walton (*American Naturalist*, Vol. XL, 1906, p. 705) says:

The absence of any tentacular process in *Naidium osborni* suggests that until a species is found in which the process is well developed and in which the dorsal bundles contain biuncinate setæ, the genera may be considered distinct.

Walton prophesies the finding of such a species, and apparently suggests the inference that when such a species is found the genera need no longer be considered distinct. This species has been found and will be more fully described in a later paper on the Naididæ. It was found at the University of Virginia in the spring of 1909, in an aquarium stocked from a small pond in the neighborhood. It differs from *Pristina breviseta* of India only in length, being considerably shorter, not exceeding 8 microns in length, but is otherwise identical and it seems best not to establish a separate species to receive it. In the American forms of this species the tentacular process varies greatly in length. In one individual it was not developed at all, in others it was developed to a length of several microns, and intermediate lengths are numerous. There are always, however, the bifid needle-like setæ in the dorsal bundles. But if we are to make this a generic character, why not make the presence of serrations on the capilliform setæ a generic character? And while we set off those forms with the bifid setæ in the

dorsal bundles and no well-developed tentacular process, what shall we do with *Pristina dadeyi*, which has neither tentacular process nor bifid dorsal setæ? Michaelsen's recombination of the two genera, therefore, is confirmed by the finding of this form, and it is correct to include under the head of *Pristina* all the species hitherto described under the heads of *Pristina* and *Naidium*, whether the prostomium be tentacular or not, whether the capilliform dorsal setæ be serrated or not, and whether the dorsal bundle contain a bifid needle-like seta or not. These characters are found in parts which vary greatly and the great resemblances among the various species in the position of the setæ and of the internal organs are more important.

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#### CONCURRENT INFECTION BY FIVE SPECIES OF INTESTINAL WORMS, INCLUDING SCHISTO- SOMA MANSONI

INSTANCES of the presence of two or more species of parasitic worms in one person are common and many such are on record. To cite some of the more recent literature, Garrison and Stiles, '06, in an examination of 3,457 persons, found that thirty-five harbored two species of intestinal parasites and that one was infected with three species. The Porto Rico Anemia Commission, in the course of its very extended studies, found frequent instances of double infection, not rarely triple infection, and, in two cases, determined the presence of four distinct species. Piraja de Silva, '09, working in Bahia, Brazil, reports several similar cases of quadruple infection. A case which has recently come to my attention is of interest not only as an extreme case of concurrent infection but as one of the few known instances of the occurrence of the blood-fluke, *Schistosoma mansoni*, in the United States.

On May 3, a local physician sent to me, with the request that I make a blood examination, a Porto Rican who exhibited obscure symptoms suggestive of filarial infection.